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XVI
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THE PROTECTION OF VANISHING SPECIES

The Science and Man Symposia were held on three evenings during the Congress. Each symposium was designed to explore an important biological problem that besets man and to show how biological knowledge can assist in the solution of the problem.

This symposium, The Protection of Vanishing Species, was sponsored by the International Union for Conservation of Nature and Natural Resources (IUCN) and the World Wildlife Fund. The Chairman for the session was Jean G. Baer (Ira N. Gabrielson was to have been the Chairman but he was ill at the time of the Congress).

THE PROTECTION OF VANISHING SPECIES

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***Manuscript not received at the time this volume was sent to the printer. If it is received later it will be published in the appendix of volume 5 of the proceedings.**

OPENING REMARKS

Jean G. Baer
Institut de Zoologie
Université-Mall
Neuchatêl, Switzerland

I sincerely regret the absence here this evening of Dr. Gabrielson. Dr. Gabrielson, whose whole activity in wildlife conservation in this country and wildlife conservation in the international field is extremely well known, has also now assumed new duties. Dr. Gabrielson is the Chairman of the American appeal, of the World Wildlife Fund, the Honorary President of which is President Eisenhower.

I will open this discussion by saying a few words, about the World Wildlife Fund, in general, and about the activity of the International Union of Conservation, Nature and Natural Resources with regard to wildlife.

The World Wildlife Fund was set up as an international foundation, the seat of which is in Zurich, Switzerland, and the President of which is Prince Bernhard of the Netherlands. In various countries, national appeals have been set up to work in the national field but all with one and the same aim; that is, to obtain funds for conservation of wildlife, for conservation in general; such as being able to buy land for national parks and for game reserves. There are aspects of greater importance still, such as conservation education, applying especially to the emerging younger nations.

The American appeal, as I told you, is headed by Dr. Gabrielson as Chairman, the president of the British appeal is Prince Philip; and the chairman is Peter Scott, the well-known ornithologist. In Holland, Prince Bernhard is again president. In Germany, Dr. Gerstenmeier, the Speaker of Parliament, is president; and in Switzerland, there is another organization working along the same lines. Similar organizations are being set up in Belgium, in France, and, we hope soon, in the Scandinavian countries and in other parts of the world.

As I said, the aims of the World Wildlife Fund are to provide funds for those working in conservation and for specific projects. And here I come to one point which is extremely important. Although the two organizations, that is the World Wildlife Fund and the International Union of Conservation of Nature, are absolutely distinct, the International Union serves as consulting organism to the World Wildlife Fund for the projects that are submitted to them for funds. In other words, all the projects that are set up, throughout the world, come into the headquarters of the International Union; they are very

carefully examined, evaluated, generally given a certain order of priority, and then submitted to the Board of the World Wildlife Fund. In this way any possibility of overlap is avoided because, as you may well be aware, there's not too much money in this field, nowadays, and it needs a lot.

Among the activities which bring us closer to this evening's symposium, that of vanishing species, is the whole problem of how to preserve so-called "vanishing species." And here if you will allow me, I would like to come to a certain historical point, which is of interest and importance. In 1910, that is, 53 years ago, at the International Zoological Congress in Graz, Austria, Dr. Paul Sarasin of Basel, Switzerland suggested that it was high time that zoologists took care of the species being destroyed. An International Commission was set up and unfortunately, as often occurs to many of these commissions, it never met. Then the First World War ensued and the whole matter, as you may well imagine, was dropped. Nonetheless, in 1928, there was set up in The Hague, under the chairmanship and guidance of P. van Tienhoven an International Office for Protection of Nature, the aims of which were to collect as much information as possible on what was then called "protection of nature"; a philosophy that has not been entirely abandoned but that has been somewhat transformed today, becoming more realistic in a world which is also more realistic than it was 50 years ago.

Finally in 1948, there was founded in Fontainebleau, France, under the auspices of UNESCO, the International Union for Conservation of Nature, which was then called the International Union for Protection of Nature. In 1949 at Lake Success, here in the U.S., a conference was held under the auspices of UNESCO, at which the problem of vanishing species or menaced animals was brought up. It was discussed, and the whole situation, which is extremely complicated and difficult, was handed back to IUCN for further progress, and a year later the Union founded the Survival Service Commission, which was specially entrusted with the problems we are discussing tonight.

This brings us to an important point in the philosophy of "what is a vanishing species?" And you may be surprised, but I have no intention whatever of defining what a vanishing species is; because this is much too complicated. A species may be vanishing today and may be abundant within 20 years if certain measures have been taken. The most extraordinary instance, I think the best illustration, we can find of such a problem is that of the Saïga antelope, which you may recall was spread right through Europe, just after the Ice Age, and was gradually pushed back East beyond the Urals into Southern Russia. And there, some 30 years ago, 200 specimens remained. The Russians took the necessary measures and today there are over one million Saïga antelopes in that region. Something like 250,000 specimens are shot every year, as a food source of protein for the populations; and the species is not declining. This species is saved because it has been preserved--protected in the right way. And this is one of the more

recent aspects of the philosophy of conservation. One might say briefly, if you want to save something, you've got to use it. It sounds very paradoxical, but you'll hear instances from the members of this Panel, that will explain this further.

I would like now to introduce the Panelists and call upon them. We have organized this Panel in such a way that we will first discuss The Problem of Extinct, Rare and Endangered Fishes. And we will call upon Dr. Miller, who is from the Institute of Fishery and Research, University of Michigan at Ann Arbor.

We will then pass on to Threatened Mammals in North America and call upon Dr. Ian McTaggart Cowan, who is certainly not unknown to many of you, Professor of Zoology, University of British Columbia, Vancouver.

We will then pass on to the bird group, and The Threatened Species of the New World will be taken care of by Dr. S. Dillon Ripley, who is here in the capacity of President of the International Council for Bird Preservation and is still at Yale University, New Haven. As you know, he has recently been appointed Secretary-General of the Smithsonian Institution in Washington.

Vanishing species of the Old World will be treated by Dr. Jean Dorst of the Paris Natural History Museum, in France.

The Vanishing Species of Australasia will be treated by Dr. Robert Carrick of the Commonwealth Scientific and Industrial Research Organization, Division of Wildlife Research, at Canberra, Australia.

The Threatened Mammals of Africa will be treated by Mr. Thane Riney, who is Consultant to IUCN and who was, until a year ago, stationed at the National Museum at Southern Rhodesia, Africa.

And finally, the Vanishing Mammals of Southeastern Asia will be taken care of by Mr. Harold J. Coolidge, who is Chairman of the American Committee for International Wildlife Protection in Washington and who is also a Vice-President of the International Union for Conservation of Nature.

EXTINCT, RARE AND ENDANGERED AMERICAN FRESHWATER FISHES

Robert Rush Miller
Museum of Zoology
The University of Michigan
Ann Arbor, Michigan

Effective concern for the protection of rare and vanishing wildlife has been, until very recently, almost wholly confined to the warm-blooded vertebrates. Zoologists have pretty largely neglected the aquatic biota, of which the freshwater organisms--invertebrates as well as the herpetofauna and fishes--are those most critically in need of help. Unlike birds and mammals, which are well known and have a large following by terrestrial mankind, most freshwater fishes are seen with difficulty. Only a few are large enough, or of sufficient sport or economic importance, to have become specifically known to laymen, except for the aquarium fishes.

Occurrence beneath the water, the general lack of popular identification manuals, and the dearth of information on threatened species, have all combined to forestall recognition and treatment of the problem of vanishing fishes.

Ichthyologists have been negligent in not coming forward earlier with comprehensive lists of the zoologically or esthetically important fishes that deserve protection.

In 1961 a Committee on Fish Conservation was appointed by the President of the American Society of Ichthyologists and Herpetologists, and it began to function immediately. An early goal, to draw lists of endangered species of freshwater fishes--initially for the United States--was realized last May with the completion of a preliminary account of 68 kinds in the 48 contiguous states. This list, continually under revision and expansion, now approaches 100 kinds for North America (only six of which are subspecies), excluding 12 species that are either extinct or on the verge of extinction. North America includes the United States, Canada and Mexico.

Some of the endangered kinds have remarkably restricted ranges (e.g., Cyprinodon diabolis), or are rare. Others represent relict populations of species that are more widespread elsewhere. Several are southern species that have very local distributions in this country, where they are now threatened, although the species appear to be still relatively safe in Mexico.

The need for protecting relict or disjunct populations that evidently represent species widespread elsewhere, may be questioned. Intensive work on the genetics of living populations, however, has shown

and may continue to reveal that (1) some of these populations are so distinctive that they actually merit full species rank; and (2) the relicts possess certain genetic combinations that do not recur elsewhere in the range of the species. Here then may reside gene pools that are in the act of evolving new adaptative peaks that will come to represent new taxa.

At the present time we simply do not know enough about racial variation at the experimental level to even guess about the relative value of maintaining such disjunct genotypes. But if we allow these to disappear by adopting the attitude that we need not be concerned since the species as a whole is not endangered, we then will not be in a position to learn whether these disrupted populations possess distinctive traits of evolutionary significance.

Thirty-eight species of North American freshwater fishes are now either seriously endangered or are of such noteworthy zoological interest that they deserve protection. The urgently threatened fishes comprise a rather diverse assemblage of 21 species, as follows: a trout (Salmo gilae, Fig. 1), 6 minnows, a lake sucker, the Mexican blind catfish of northern Coahuila (Prietella), 4 killifishes, a goodeid (Ataeniobius), 4 viviparous topminnows, a blind synbranchid (Furmastix) of Mexico, a sunfish in California, and a Maryland darter right near where we are speaking this evening. The remaining 17 species include: the localized relict Olympic mudminnow of Washington (Novumbra), the bizzare humpback chub (Gila cypha), and the Colorado "salmon" (a huge minnow, Ptychocheilus lucius) of Colorado and Utah, a sucker, the cui-ui- (Chasmistes cujus), confined to Pyramid Lake, Nevada, the rapidly declining desert pupfish of Arizona and southeastern California, a localized genus and species of the wholly Mexican family Goodeidae (Hubbsina), the northern platyfish of Coahuila, Mexico, the Suwanee bass of Florida, the blind brotulid (Typhliasina) of Yucatán, a Mexican darter, and two Mexican mojarras of the family Cichlidae.

Among the most endangered species are five from the American Southwest. The Little Colorado River spinedace of Arizona, the Comanche Springs pupfish of Texas, the Pahrump killifish of Nevada, the Clear Creek gambusia of Texas, and the Monterrey platyfish of northern Mexico. The Arizona spinedace and Texas pupfish have suffered from a combined attack of lowered water tables, domestic polution, introduction of exotic competitors, and repeated chemical treatment of their habitat by fish and game personnel. Each species is now reduced to a precarious level, from which recovery is possible only through prompt and strict protection of the remaining habitat. The Pahrump killifish has been affected by the recent introduction of goldfish into its single spring-pool habitat, and by the removal of much aquatic vegetation, and its abundance may also be influenced by that of the exotic bullfrog. This threatened killifish constitutes the last known population of an endemic desert genus of great scientific interest.

The Mexican platyfish is perhaps now more abundant in aquaria at the American Museum of Natural History than it is in the remnant of its native habitat in Coahuila. The Texas gambusia, a highly restricted species only recently described (1957), is threatened by the proposed construction of a dam and competition with the mosquitofish (Gambusia affinis).

Another phenomenon that poses a threat to the survival of native species is the accidental or intentional release of bait fish and home aquarium fishes into natural waters. This is a particularly serious problem in areas with depauperate faunas, such as those of the Southwest (see Deacon, Hubbs, and Zahuranec, Copeia, 1964, in press), since the isolated native forms lack the defense mechanisms that are developed in more nearly saturated faunas, and hence have proven to be rather easy prey for the typically more aggressive exotic species.

Documentary evidence for changing fish faunas is not easy to obtain, but is illustrated by repeated collections over more than a century in southern Arizona (Table 1). In 1851, on one of the Pacific Railroad exploration surveys, a naturalist stopped at the San Pedro River, a tributary of the Gila River, and collected 11 native species. At that time the San Pedro was a permanent, large stream with much aquatic vegetation, trees along the banks, no indications of erosion, and with a variety of habitats. These are indicated particularly by the humpback sucker (Fig. 2), a large fish that likes rather deep and swift water; the flannelmouth sucker, which also requires a strong current; the huge, so-called Colorado "salmon," which we will speak more about later; and the desert pupfish (Fig. 3), which prefers quiet, marsh-like conditions.

Around 1880, extensive arroyo cutting began in southern Arizona, in part at least as a result of over-grazing, and the habitat began to be seriously altered. By 1904 the humpback and flannelmouth suckers, as well as the Colorado salmon and desert pupfish, had disappeared due to changing water conditions. In 1939 only 4 of the original 11 species remained as the stream further deteriorated. By 1950 only 3 native species survived and the spikedace, which requires pools, vanished within the next decade. This is rather typical of what has happened in some parts of the major stream systems of the American Southwest.

The Pahrump killifish (Empetrichthys latos, Fig. 4), mentioned earlier, was described in 1948 on the basis of three disjunct populations in a small valley east of Death Valley. By 1958 two of the populations had disappeared through destruction of habitat. Within the last year and a half, the third and now only surviving population, in its small spring-pool habitat, was influenced as I have indicated by the introduction of exotic goldfish and other disturbances. The only other species of Empetrichthys, E. merriami of nearby Ash Meadows, has not been collected since 1957.

TABLE 1

DEPLETION OF NATIVE FISHES IN THE SAN PEDRO RIVER

NEAR FAIRBANK, ARIZONA, FROM 1851 TO 1960

Species	1851	1904	1939	1950	1960
Colorado chub, Gila robusta	x	x	-	-	-
Colorado squawfish, Ptychocheilus lucius	x	-	-	-	-
Speckled dace, Rhinichthys osculus	x	R	-	-	-
Longfin dace, Agosia chrysogaster	x	x	x	x	x
Loach minnow, Tiaroga cobitis	x	x	x	x	x
Spikedace, Meda fulgida	x	x	x	x	-
Sonora sucker, Catostomus insignis	x	x	-	-	-
Flannelmouth sucker, Catostomus latipinnis	x	-	-	-	-
Humpback sucker, Xyrauchen texanus	x	-	-	-	-
Gila sucker, Pantosteus clarki	x	x	x	-	-
Desert pupfish, Cyprinodon macularius	x	-	-	-	-
Totals:	11	7	4	3	2

R = rare. Taken in part from Miller (1961a: 376).

The Sacramento perch, a member of the North American sunfish family to which the bass and the bluegill belong, is an extremely interesting relict naturally occurring today only in California. The only native sunfish west of the Rocky Mountains, it is now far removed from the range of the remainder of the family, but a close fossil relative lived in southern Idaho about 3 million years ago. It has very interesting habits, differing from other sunfishes in neither building a nest nor guarding its young. This probably has led, in part, to its downfall because of competition from more aggressive eastern sunfishes that have become well established by introduction into California. The species has dwindled to the point now where if we do not take some action to preserve it the Sacramento perch may disappear in the near future within its native range. It has become successfully established in Nevada and, very recently, in alkaline sandhill lakes of Nebraska.

The Devils Hole pupfish Cyprinodon diabolis (Fig. 5) is confined to a single small spring hole, east of Death Valley, and has a total population varying between about 100 and 400 individuals (Miller, 1961b: 548). Almost all of the population may be seen at one time in the clear spring. Since it was recognized that a species confined to such a small space and numbering so few individuals might readily be wiped out, the Devils Hole area of about 40 acres was added to Death Valley National Monument in 1954. This is one of two North American fishes now receiving protection. (The other is one of the blind fishes that lives in Kentucky.)

Another pupfish, Cyprinodon radiosus, was described in 1948 from Owens Valley, at the eastern base of the Sierra Nevada Range, California. Although it was abundant in the northern part of the valley in the early 1900's, the last verified specimens were collected in 1939. However, the species was reportedly taken as late as 1956, so there is still hope that perhaps a residual population of the Owens Valley pupfish still survives in that area. An intensive hunt for the species will be made in the summer of 1964.

The Little Colorado spinedace, Lepidomeda vittata (Fig. 6), belongs to an interesting tribe of minnows confined to the Southwest and recently reviewed by Miller and Hubbs (1960). These are the only native minnows in the Western Hemisphere that have spiny elements in their dorsal and pelvic fins. Once widely distributed in the Little Colorado system, it has since 1939 become greatly restricted by man and is now known to survive only in a five-mile stretch of Clear Creek (Miller, 1963). We are very concerned about this species and are making an active attempt now to get a small section of its habitat set aside.

The largest North American minnow, the so-called Colorado salmon or squawfish, is a predatory fish that once probably grew to lengths approaching six feet and weights of more than 80 pounds. The reference to "salmon" stems from the belief of natives that the species migrated

up the Colorado River (but not from the ocean) on spawning runs. Since the extensive series of dams have been built along the Colorado its distribution and abundance have been curtailed. It was so common in the Colorado River drainage of Western United States in the early part of this century that individuals were pitchforked out of irrigation ditches near Yuma for fertilizer. Today the fish is a rarity in the lower Colorado but still occurs in numbers in the upper basin in Colorado and Utah. This is a big-river fish, known only from the main stem of the Colorado River and its major tributaries.

Gila cypha (Fig. 7), the humpback chub, is a bizarre minnow, highly specialized for life in swift water. In addition to the peculiar hump on the back it lacks scales over much of its body--presumably an adaptation for reducing friction. The species attains a total length of about 16 inches. Virtually nothing is known of its life history, but studies of its biology are now in progress. Much of the prime habitat of this fish was poisoned during the Green River fish management program of 1962, although it is believed that the species still survives in unaffected parts of this drainage in Colorado and Utah. If the Yampa River of Colorado were declared a primitive river not to be altered further by man (dam building, chemical treatment, etc.), both this species and the Colorado squawfish should find a suitable refuge.

In closing I would like to quote the final paragraph of my 1961 paper, "Man and the Changing Fish Fauna of the American Southwest."

"Interference by man with delicate and complex ecological balances has had dire consequences in many parts of the world. Perhaps nowhere else in North America has the upset of natural conditions been more strikingly reflected by biotic change than in the arid Southwest, particularly in southern Arizona. Overwhelming evidence indicates that modern man, rather than climatic change, has been the chief agent in producing the observed changes. Removal of vegetation by overgrazing and forest cutting has been the most important single cause of erosion. The deterioration of the native fish faunas can also be plausibly attributed to construction of dams, water diversions, pollution, mining operations, use of toxic chemicals, depletion of ground water, and the introduction of alien species."

There is still time left to protect our native freshwater fishes, but effective and prompt action will be needed to save the most seriously threatened ones from extinction.

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LEGENDS

Figure 1. The Gila trout, Salmo gilae, a species formerly abundant in cold tributaries of the Gila River basin of New Mexico and Arizona. The game and fish departments of each state are now making every effort to save this attractive game fish.

Figure 2. The humpback sucker, Xyrauchen texanus, so named because of the high keel on its back, occurs only in the Colorado River basin. Attaining a length of about 3 feet and weights from 10 to 14 (occasionally 16) pounds, it has been used as food by both aborigines and whites. Although now scarce over much of its range, the species has adjusted well to the artificial impoundments in the lower Colorado River drainage.

Figure 3. The desert pupfish, Cyprinodon macularius, has been extinct in the San Pedro River in Arizona (from which it was described) and over much of the southern part of the state for more than half a century (Table 1). Today it survives in Arizona in only two springs, although it is still common around the Salton Sea, California, and lives in one creek in Sonora, Mexico. Male above, female below; length, 2 inches.

Figure 4. The Pahrump killifish, Empetrichthys latos, male above and female below. Empetrichthys, a genus confined to two basins just east of Death Valley, is represented by two relict species, one of which may be extinct. The other, pictured here, now survives in one spring pool, where it is endangered by exotic species (goldfish, bullfrog) and modification of its habitat. Length, 2 inches.

Figure 5. The Devils Hole pupfish, Cyprinodon diabolis, male above and female below; maximum length about 1 inch. This dwarf species is restricted to a single spring hole east of Death Valley.

Figure 6. The Little Colorado spinedace, Lepidomeda vittata, is one of six species of a group of peculiarly modified minnows that inhabit the lower part of the Colorado River basin. The specimen illustrated (3 inches long) came from the Little Colorado River in eastern Arizona where it was last caught in 1939. Today this endangered species is known only from a small segment of one tributary of the Little Colorado River (Miller, 1963).

Figure 7. The humpback chub, Gila cypha, is remarkably specialized for life in the torrential waters of the Colorado River drainage. Originally described from the Grand Canyon the species has since been reported from Colorado, Utah and Nevada but is losing out as man pollutes the habitat, introduces exotic competitors, and transforms the once swift Colorado River into placid reservoirs.

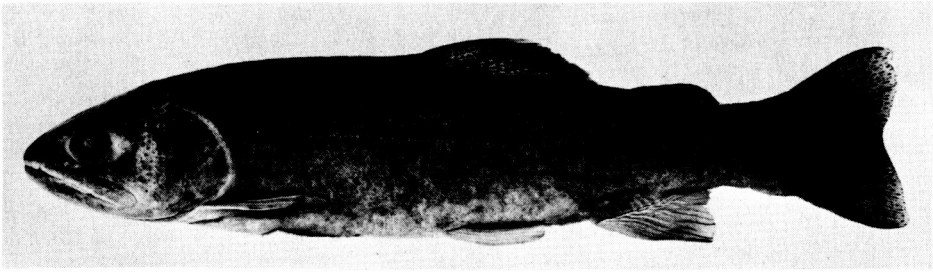
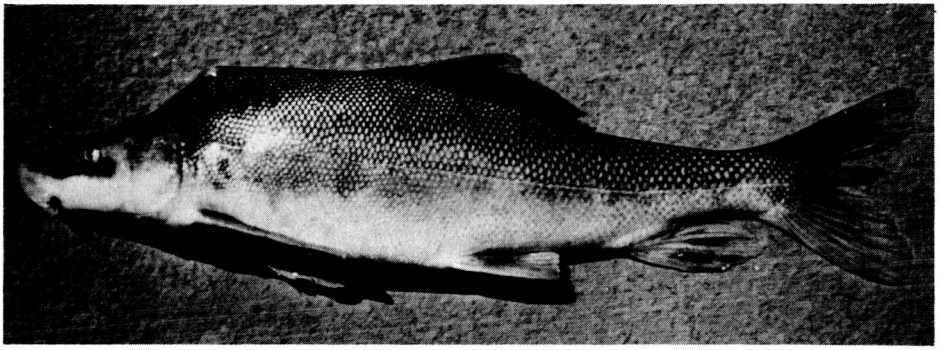


Fig. 1



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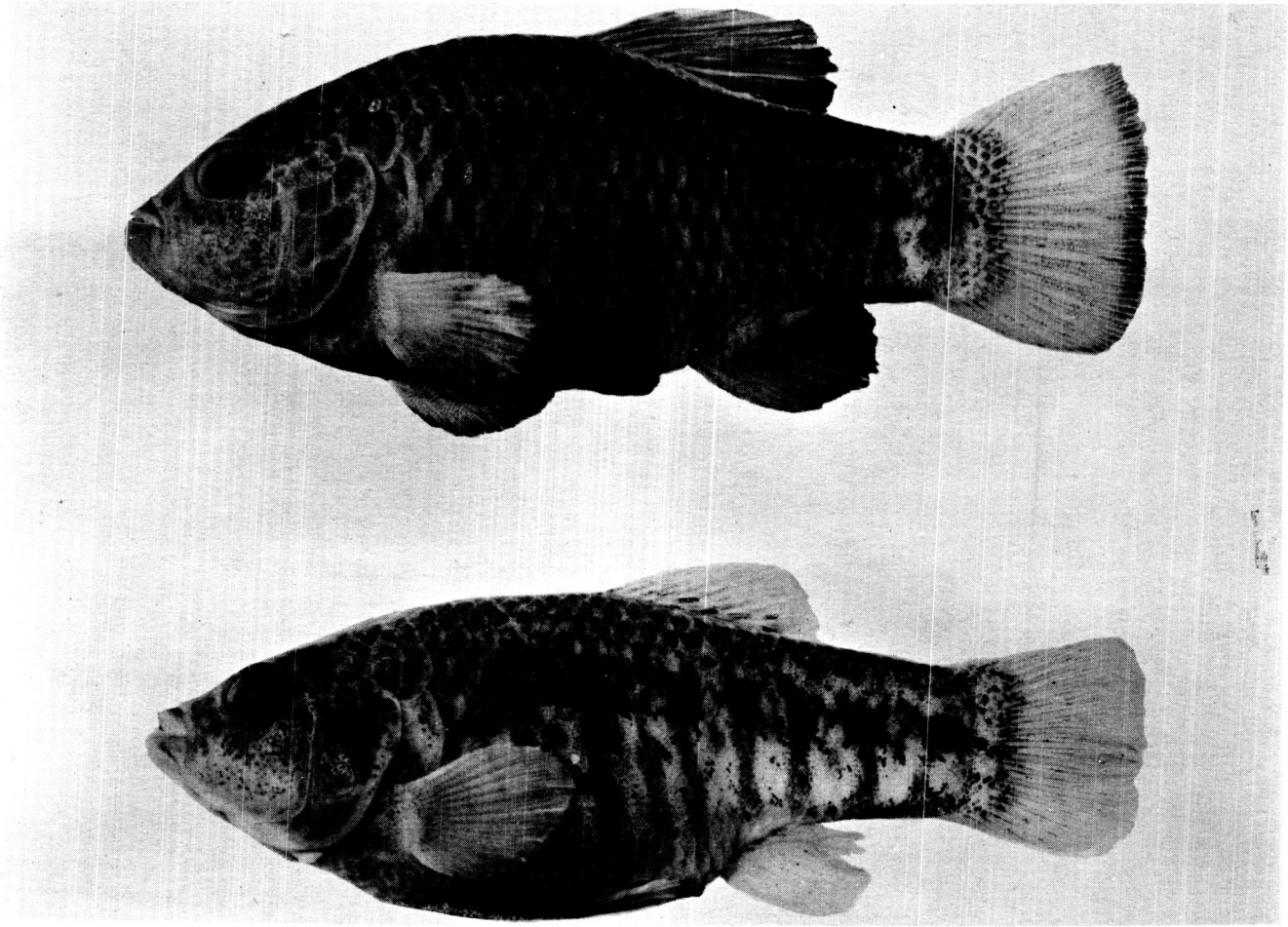

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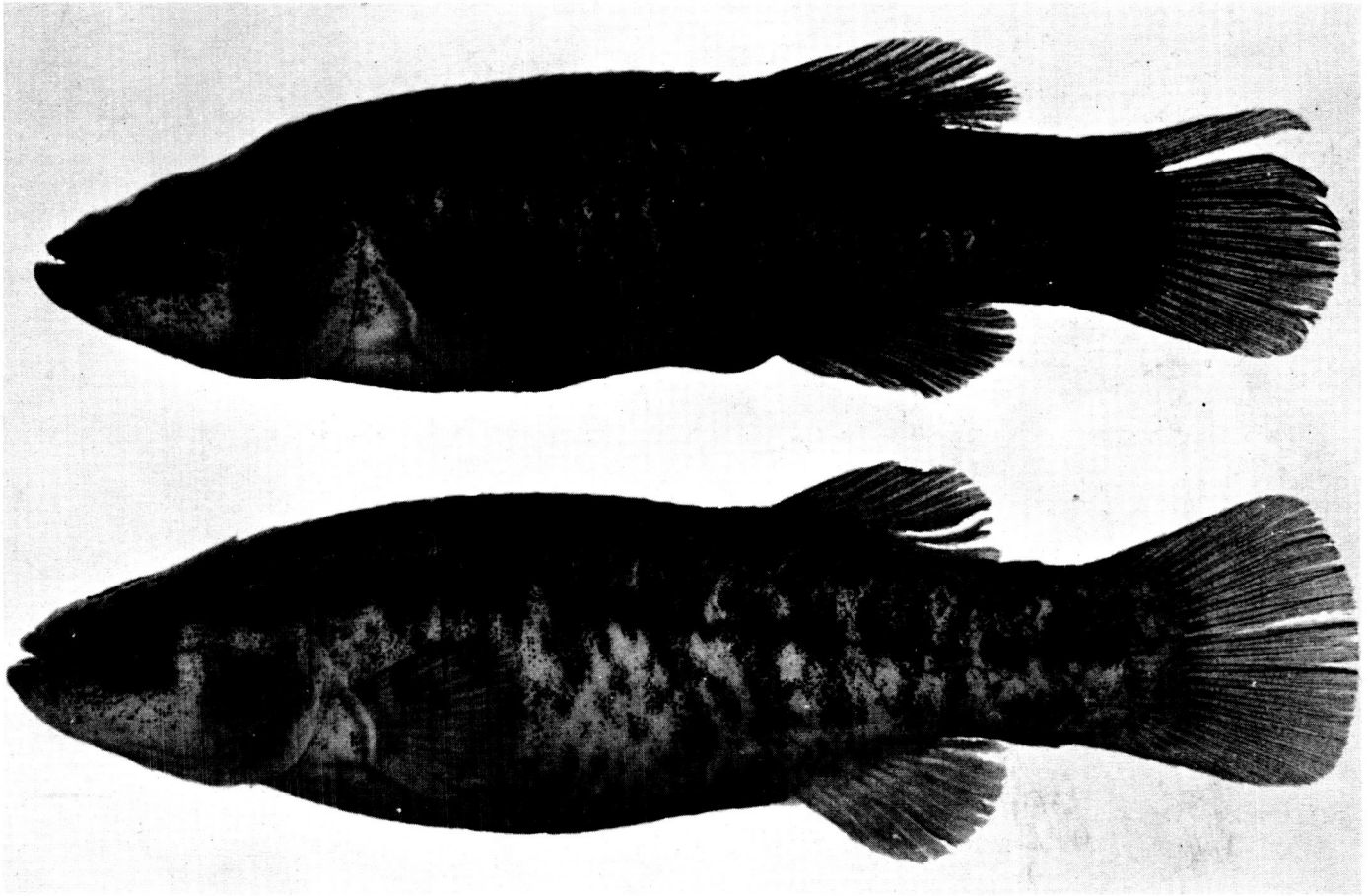

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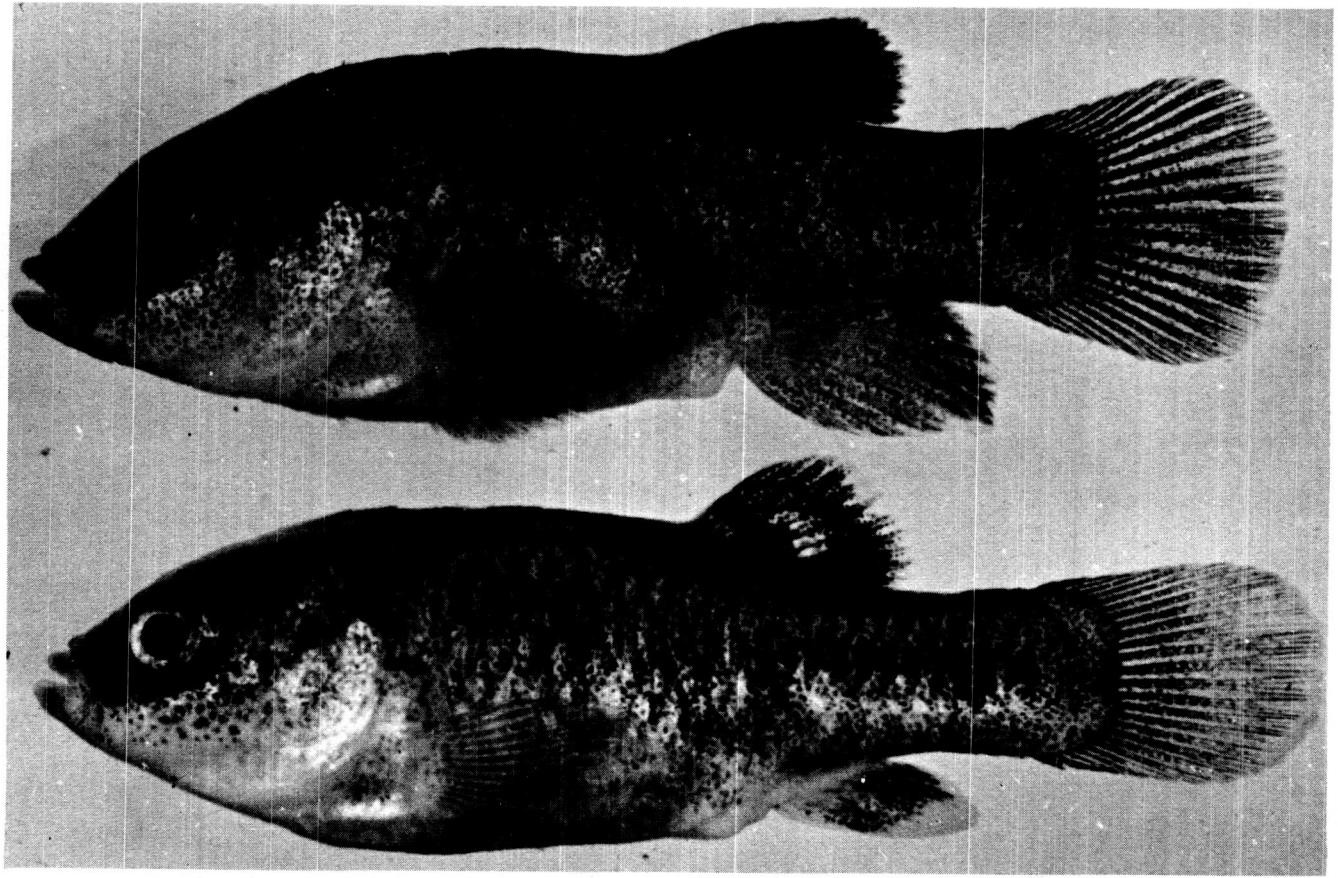

Fig. 5

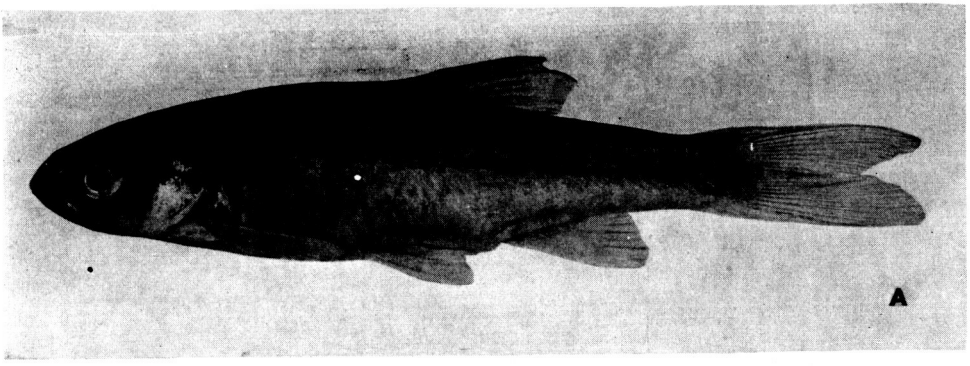

Fig. 6

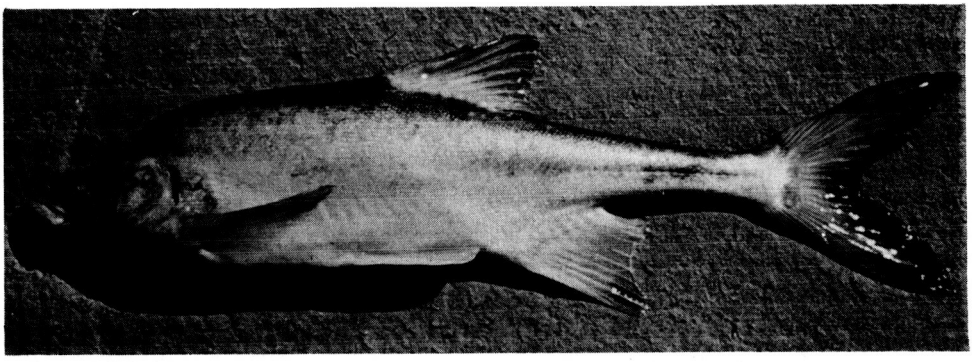

Fig. 7

THREATENED SPECIES OF MAMMALS IN NORTH AMERICA

Ian McTaggart Cowan
Department of Zoology
University of British Columbia
Vancouver, B. C. Canada

My task this evening is to discuss briefly the extinct and endangered mammal species of North America. I have chosen to confine my considerations to continental North America and the closely adjacent islands except for the Caribbean islands.

In 1942 Allen, at the behest of the group that our Chairman has described, prepared and published a list of the endangered and vanishing species of North American mammals. At this time there were 28 species listed which he regarded as being in danger of extinction. I am sure some of these were put on the list largely because he had not enough information to decide whether they were or were not endangered. Since that time one of the species on his list has been found to be extinct. This is the unique dwarfed Caribou living on the Queen Charlotte Islands on the North Coast of British Columbia.

It was not exterminated by man directly; it was probably a vanishing species without his instrumentality. Its demise was hastened, however, by the introduction of an alien competitor--the Coast Black-tailed Deer--which was not previously present on the Queen Charlotte Islands. Our most exhaustive searches in this rugged country, within the last few years, have convinced us that it no longer exists. Apart from this extinct species, I think we can acknowledge some satisfaction that today, of the 28 species we were concerned about 25 years ago, only 7 are still on the critically endangered list.

As our Chairman has already said, we are plagued in this review by the problem of criteria. Are we, for instance, interested in the preservation of the major sub-species, the most important minor genotypes, or are we concerned only with those animals which all systematists will recognize as species?

Here we run into the current concept of what a sub-species is and what its value is to the biological scientist. One school of thought tends to downgrade the sub-species as of no particular importance.

There can be no objectivity here, and my criteria will be better seen in retrospect than they can be defined. I think we should be objective, however, as to what does constitute a vanishing species. Here again, it is most difficult to arrive at satisfactory criteria. It has

been suggested that any species which reaches a level of less than 1,000 individuals can be considered to be vanishing. I could cite several species and many more genotypes of a minor nature, the total population of which probably never exceeded this number.

I could take you to mammal populations that have evolved and are living their entire lives on an island of less than five acres--and yet they are very distinctive genotypes. We know almost nothing about the critical mass in vertebrate populations (the number below which extinction is a likely prospect merely through the accidents of normal fluctuation). The mathematical concepts involved have been discussed by Larkin and Leslie (J. Fish. Res. Bd. Canada. 20: 647). So here again it is difficult to be as objective as we would like to be.

Let us turn then to the list as it now stands. I have put only two species on the critical list, if we can use hospital terminology. The first of these is the Blackfooted Ferret, Mustela nigripes, a very close congener of Mustela eversmanni of the comparable regions of Eurasia. In the last 10 years or so there have been 55 sightings of this species in 15 counties of South Dakota and one county of North Dakota. Of these sightings 6 have been animals killed by automobiles. The latest report was on September 22, 1963. (D. A. Janzen, U. S. Fish & Wildlife Service in litt Oct. 30, 1963). There are three individuals in captivity.

This species lived in close association with the prairie dog, and its range extended north into Saskatchewan. The extensive poisoning campaigns to eliminate the prairie dog from the agricultural regions of these prairie provinces have led to the virtual extinction of the Blackfooted Ferret.

The second species is the Mexican Grizzly (Ursus arctos sheldoni) the southernmost, so far as we know, of the very varied group of grizzly bears of North America. This race was believed to have been extinct for many years. But a few years ago Starker Leopold, of the University of California, rediscovered a small population in the Sierra de Nido of Mexico. His estimate is that there are between 30 and 40 individuals in this small range of mountains. The greatest danger arises from the introduction of sodium fluouroacetate, the poison 1080, onto the very restricted range of this interesting form. Already a female bear and her two cubs have been found dead close by one of the poison stations. This poison does not kill quickly; it may take two, three or more days to kill, and it is unusual to find the animals poisoned with it. The finding of 3 dead suggests that several others may also have been victims. This is a desperately serious situation to those of us interested in conserving the species.

I have three animals on the extremely vulnerable list. That is, they are down to a population size that is vulnerable to quick change in the habitat or to an alteration in our political view of their

value. The first of these is the Wood Bison (Bison bison athabascae), the largest of the extant North American bison, and very similar to one of the pleistocene forms. We recently found that we still have a herd of somewhere around the 250 to 250 mark, reasonably isolated from the introduced herds of Plains bison that were by grave error, placed in the ancestral home of the Wood bison. There has apparently been some genetic contact between the two herds--a fact deduced from the presence among the Wood bison of diseases that are believed to have been introduced with the Plains bison. In our present attempts to perpetuate the Wood bison, the Canadian Government is catching up and trying to isolate a herd of clean animals that can be put in a place where they will not be in contact with the Plains bison. The existing herd is not endangered by over-shooting by man; it is in an area where we are not going to encroach on its habitat. The dangers are first, disease; and second, genetic inundation.

The Mexican Tapir. I have no reliable information on its numbers, but I am informed that it is extremely rare in Mexico and in adjacent parts of Central America. Information is that there is no effective protection, even though killing is prohibited.

The Red Wolf (Canis rufus). Information has been provided by D. A. Janzen, of the United States Fish and Wildlife Service to the effect that the service estimates the red wolf population at between 4,000 and 8,000. Predatory animal control operations have killed from 2,200 to 2,700 of these wolves annually over the last four years. It thus appears that there is a stable and productive population of these wolves primarily occupying Texas and Arkansas. The population in Oklahoma appears to be endangered.

There are two races of the white-tailed deer, Odocoileus virginianus that can be considered vulnerable. The key deer, Odocoileus virginianus clavium, the smallest of the white-tails, isolated on the southern group of Florida Keys, is now known to number between 225 and 235 with the population about static and a sex ratio of one buck to three females. This appears to be a healthy herd that probably is at, or close to, the carrying capacity of the environment. It has full legal protection and a refuge of about 7,000 acres. I think we can regard this as safe in the meantime.

Another white-tail has been almost unheard of; the Columbian white-tail Odocoileus virginianus leucurus has been isolated on two small islands and a small pocket of adjacent mainland at the mouth of the Columbia River since somewhere around 1827. There is reported to be another small population on a refuge near Roseburg, Oregon. So far as I can determine the numbers of this race probably do not exceed 600 animals. It is protected largely by its residence on private or protected property owned by men who are interested in its survival. It is a very interesting sub-species, the only white-tail which adapted to the extremely humid West Coast forest region.

There are a few species of mammals in North America that are in small numbers but are not presently endangered. We should carry a watching brief on these: the Barren Ground Grizzly Bear, Ursus arctos richardsoni, of the Northwest Territories, probably between 350 and 400 plus or minus a few in existence; the Kodiak Bear of Kodiak Island, Alaska, Ursus arctos middendorffi, presently in good numbers; one of the sub-species of the Fox Squirrel, Sciurus niger cinereus, which lives almost in Maryland; the Button-willow or Dwarf Elk, Cervus canadensis nannodes, of the southern San Joaquin Valley. Again, there are probably not more than two hundred individuals, but they are under good management.

Two species are having trouble on the international scene, although they are still present in numbers that encourage pursuit: The Harp Seal, Phoca groenlandica, is being mismanaged; its numbers have been declining steadily and alarmingly. The Blue Whale, Sibbaldus musculus, the greatest of all the world's present mammals, is in a critical condition. Because of international misunderstanding, neither of these is being accorded the protection it should be receiving.

There are still five small species of mammals that are probably in danger. As we have no information whatsoever, I pass the names of these on to biologists in their resident areas as interesting opportunities for further investigation: Microtus breweri of Muskeget Islands, a sub-species of California field mole that lives in the Owens Valley region; Microtus californicus scirpensis, a sub-species of the common meadow-mouse of Eastern North America; Microtus pennsylvanicus nesophilus of Gull Island, New York; and two species of kangaroo rats, Dipodomys elephantinus and D. elatior, both of which occupy extremely small ranges in areas where water is now being poured upon their desert habitat as it is converted to agricultural use. Recent information on all of these is urgently needed.

Our situation, then, has changed. Almost none of the threatened species is being menaced through direct killing by man (our earlier problem). Almost all that are presently in danger of extinction are now experiencing the consequences of alteration in their habitats arising from human activity. Lumbering, irrigation, tillage, urbanization, chemical control of noxious animals, and the use of chemical insecticides and herbecides are now the most serious threats to the North American mammals.

I would like to close by pointing out the research opportunities these species offer, and how little they have been capitalized upon. We are extraordinarily interested in evolution, and one of the logical end points of evolution has been extermination. I know of no objective study of the biology of extermination. The student of animal populations can find in these peculiarly adapted and localized populations fascinating opportunities for research. The ethologists, the ecologists, the student of physiological ecology, and the geneticist all have here source material of extraordinary value and can find most rewarding opportunities for biological research.

Finally, I realize that there are among my colleagues, some who are so unsure of themselves that they shrink from showing enthusiasm other than of a purely scientific nature for any of our biota. I am afraid I am not one of these. I find these creatures interesting in themselves--worthy subjects for our active concern--and I know that there are thousands who share my view.

THREATENED BIRDS OF THE NEW WORLD

S. Dillon Ripley
The Smithsonian Institution
Washington, D.C.

It is a pleasure to be here, representing the International Council for Bird Preservation, of which I am honored to be President, whose ninth bulletin has just been published. We have a 41 year old history of concern about birds of the world, and in more recent years particularly about vanishing birds.

What a particularly healthy state zoology is in, at this moment, in that we zoologists assembled here can really passionately concern ourselves with vanishing species. Only a few years ago, to draw a phrase from our Chairman this evening, Professor Baer, it would have been appropriate for the museum-minded zoologists to take care of the species by simply taking care of the remaining specimens if they happened to be in an isolated environment, and available to the collector.

I recall that on Guadaloupe Island there were some seven specimens of the Guadaloupe Hawk, the Caracara, all in a large dead tree on the top of the Island, and a particular museum collector took care of all seven of them, so that they would be available for future scientific research, in the Museum.

I also recall that it has not been many years since some of my colleagues, perhaps overly laboratory minded, complained of the strange sort of heterosis that affected the faunas of the world. They realized that it had become necessary suddenly to consider something more than a common rat or a common pigeon, or even more recently a common sort of monkey in their experiments; although I'm not sure quite what sort of monkey they were referring to?

Nowadays it is sensible and useful to consider the fauna, in its diversity, in its heterogeneity, as something of enormous potential value for the future. The very diversity of species is exciting and highly worthwhile. Now as far as birds of the New World are concerned, we have a critical list too.

And we have, perhaps, four possible ways of considering them. The first way, is to do absolutely nothing about them. We have a species for example, for which we can do absolutely nothing. This is a bird which for a number of years was thought to be extinct. It is on our critical list, it is called the Eskimo Curlew. In years gone by, people shot Eskimo Curlews in North America, in enormous numbers,

wagon-loads of carcasses are described as having been taken away at the end of a day's shoot, and so on. And beginning about 1935 no more Eskimo Curlews were seen. But about 1960, one, and then two, birds appeared in late March or early April, along the coast of Texas in the Galveston area, elusive, tantalizing, will-o'-the-wisp, no one knows whence they come, no one knows where they are going, to what area of our continent - they come and go on their own particular mission. And there is absolutely nothing, as far as I can see, that we can do about them. We can deplore the situation, publicize the fact that no small Curlews should be shot, and so on, but that is about it.

Then there are those sorts of birds that we can do something about. We can set aside refuges, we can publicize the fact that they are almost extinct, and we can hope for the best with all possible fingers and toes crossed.

One of these is the California Condor, which occurs only in a small park, Los Padres east of Santa Barbara; perhaps about 50 birds--Dr. Miller might tell us better--but a very small population. And really there is very little we can do about it except by publicizing the fact that these large pleistocene relics should not be shot, poisoned with poison-bait carcasses, or otherwise disturbed; we can hope for the best and more or less let it go at that. There might conceivably be a possibility that such a bird could be bred in captivity, step number four, but that again is debatable. So there are these sorts of birds that we can simply think about and set aside refuges for, and say "let's hope for the best."

There is a third category, in which it might be possible to adopt some mechanical provisions to protect them. And such a rather fascinating one is the little Bermuda Petrel called the Cahow, which lives on the Island; that is, nests on the Island of Bermuda. Once very prevalent, the species was a staple source of food to early settlers there, but it has now long since disappeared from the public eye. There are perhaps, six breeding pairs. They wander out into the seas adjacent, no one knows exactly where, but they do come back to little coral islets, rat-free, just off the main Island and nest there. Unfortunately, their worst enemy is not man but another bird, the Bo'sun bird, the Yellow-billed tropic-bird. This sea-bird, this gull-like creature, coming in and nestling in the same sort of burrows, just as the young Cahows are being fed by their parents, spears the young petrels to death. So here a mechanical device is possible. A simple sort of drainpipe-like tube of galvainzed iron can be put in the mouth of the little cavelet where the petrels nest, allowing them to go in, but preventing the Bo'sun bird from nesting in the burrow. As a result the adult Bo'sun birds can't spear the baby petrels to death. In this way the population can mechanically be stimulated to hold its own against another bird adversary, in this case in a contest for nesting sites.

And the fourth possibility is a tricky and complicated one, which I might call avicultural management, in which it may be possible to rear species in captivity as has been done with some mammals, such as the American buffalo, the pronghorn antelope and so on; rear in captivity a population of a critical species and release them again in suitable habitats. This is currently being done with the Hawaiian Goose or Nene of the main island of Hawaii, which has now become so numerous in captivity that it is being reintroduced into its native habitat and will soon again be plentiful, and therefore is subject to avicultural management. There is absolutely nothing wrong with captive-reared Hawaiian geese so far as we can see, they have exactly the same genetic constitution as the parent wild birds. They behave like wild birds, take off, fly and that is that. It can be done, and this is a great triumph for this particular type of management.

So, perhaps, in the future, if we are going to save one or two of these critical species of North America, like the Whooping Crane, which is down now to 28 wild birds and 6 captive birds, some really serious crash program of management of this sort should be adopted.

As far as the overall picture is concerned there are some 21 species and subspecies of North American birds now on our endangered list. Populations as Dr. Cowan said, under a thousand, in some cases like the whooping crane are down to 28 in the wild state. We don't know what we can do about some of these, like the Eskimo Curlew; there are mechanical things we can do with others. There are possible management solutions with still others.

One thing that we should certainly avoid, in some cases, is attaching too much publicity to species. It can be quite dangerous. At certain stages of culture, for example, in parts of the Americas, to become excited about a local species which is dangerously threatened, down in numbers, and publicized in the local press may be catastrophic for that species. There will often be people who feel that they must have a stuffed specimen of this rare species over the television set in their rumpus room just to commemorate the event. So this all has to be done with a great measure of awareness. We have to attack each particular situation on its merits. Some birds obviously are going the way of all flesh. Others can still be saved.

But meanwhile it is greatly worthwhile to try and do the best we can--and how nice it is that so many of us feel this way about it.

VANISHING BIRDS OF THE OLD WORLD

Jean Dorst
Muséum National d'Histoire Naturelle
Paris, France

For many decades scientists and conservationists have been much concerned about the fate of many species of birds. As a matter of fact, the problem of extermination of birds is a very old one. And several species have disappeared a long time before modern times.

During the 16th and 17th centuries, several species were eradicated, particularly early on islands, the insular environment being so fragile. May I recall the celebrated Dodos, of Mauritius, exterminated through human action, hunting for their flesh, and La Reunion destroyed by pigs, cats, dogs, and even monkeys.

Several other species became extinct from over-hunting or from an actual eradication campaign (the Passenger Pigeon). But these dramatic examples were only a few in the world, which was until then untouched in many of its parts. In the past few decades, however, this situation has greatly changed and become by far more serious.

First we must not forget that the human population has increased tremendously and that man with all his modern tools of destruction of nature has now spread all over the world, even to the remotest places. Therefore, the problem has a world wide range and must be dealt with that aspect in mind. Which are the main causes of disappearance of birds over the world? The first, and the most obvious one, is hunting and over-hunting.

We must bear in mind that the total populations of most of the birds are terribly low, even species which are still considered common. For example, in Europe wild fowl as a whole is still considered common. But according to the censuses that are made by the International Bureau of Wildlife Research, the total populations of several species, and especially geese, do not exceed several thousand individuals. These populations concentrate in winter in small areas (especially during severe winters). During the cold spell from January to March of the current year, huge concentrations of ducks, of geese, of swans, were observed in western Europe as a whole (especially in western France). Flocks of thousands were seen and some bird-watchers and hunters concluded that all these species are still numerous. In fact, these flocks represent the whole population and are thus very sensitive to human impact. As a matter of fact, these birds pay a heavy toll to hunting, and to food and water shortage. In some cases one-third of them were killed by frost or destroyed by hunting.

In other places birds are netted for gastronomical enjoyment, as in many Mediterranean countries; or hunted for their feathers as, for instance, the Birds of Paradise in New Guinea--in spite of the protection given by the Indonesian Government. Or birds are killed just for pleasure. But the destruction or transformation of habitats must be considered the most important factor in reducing population of birds.

The clearing of forests, is probably the major factor. Deforestation is going very steadily ahead all over the world and is particularly disastrous in small islands. In the Philippines, the Island of Cebu had been largely deforested by the early 20th century. All but one of its endemic forms of birds may have disappeared.

In Mauritius, where already two-thirds of the birds were already extinct by the beginning of the present century, and where half a million people are living on an island of 720 square miles in extent, 5,000 acres of forest considered until now as a national refuge, is all that is left of the forested habitats. All the birds and animals--and among them are strictly endemic forms--all the animals will disappear if these last remnants are cleared. A small bird of prey, the Mauritian Kestrel is already represented by less than 15 individuals.

Draining of wetlands, which is going very fast over the entire world, is also one of the major factors reducing population of birds at a dramatic rate.

Since the last War, spraying with pesticides, has contributed to a large extent to the destruction of birds. These chemical products--poisons in fact, especially if over-used--are especially noxious to aquatic birds as a consequence of concentration along food-chains. And birds of prey, already so reduced in numbers by hunting and by so-called vermin campaigns, are also highly sensitive to pesticides as our British colleagues have clearly shown.

For these reasons we must say that more or less all the birds are threatened all over the world. However, we must make some distinction, and identify the most threatened among them--the true vanishing species. Now, how are we to give a definition of a vanishing species? That is a very difficult task, and several criteria must be used.

The first of all is, of course, the scarcity. As a matter of fact, we must consider as threatened every species the population of which is lower than 1,000 individuals, this figure being, of course, highly approximate. In fact, many birds, in the Old World, are far less numerous than 1,000 individuals. I shall give some examples. The Japanese crested ibis (Nipponia nippon), which was a common species distributed all over Japan 80 years ago, was practically wiped out within the 20 year period from 1870 to 1890. Now protected by law

against men, but not against severe winters and transformation of some parts of his habitat, its population has decreased to 11 according to the 1961 census.

In the Philippines, the monkey-eating eagle (Pithecophaga jefferyi), one of the largest birds of prey of the world, has a population of less than a hundred individuals. Trapping for zoo exhibition must be blamed for this extreme reduction.

The Kakapo or owl-parrot (Strigops habroptieus), endemic to New Zealand became very rare through habitat destruction, and through introduction of predators. Its population is under a hundred.

The Great Indian Bustard (Choriotis nigriceps) has become alarmingly scarce, mainly through shooting, destruction of habitat, and cultivation of its limited area of distribution. The Indian pink-headed Duck (Rhodonessa caryophyllacea) has not been found since 1935, and may be extinct.

In Madagascar, the Delalande's Coua (Coua delalandei), a kind of cuckoo endemic to Madagascar has been wiped out through forest destruction.

These are only a few examples, in areas scattered over all the world. But scarcity is not the only criterion to be adopted for putting a bird on a list of threatened species. We must also take into consideration the ecological contexts and the pressure of human interference. In some respects, some species of European geese, the number of which are higher than 15,000, are more threatened than, for instance, the Galapagos penguin, or the flightless cormorant--two species endemic to these Islands the total populations of which are less than 1,000 individuals.

If the condition remains the same in these Islands, and if these birds are not destroyed by settlers or yacht owners or zoo collectors, they will stay at the same level, which may be more or less, the same they had before human impact on these islands. But if the marshes and wetlands of western Europe are modified and drained, European wild-fowl may be wiped out, or at least severely reduced, these species being very sensitive to minor changes in their environment.

The tragic examples of the Passenger pigeon and of the Carolina parakeet, which were by far more numerous, remind us what may happen to some birds not so badly reduced in number until now.

Of course, conservationists had some very good news during the recent years. Professor Ripley told us about the Nene, or Hawaiian goose. The Takahe (Notornis mantelli), a close relative to the purple gallinule has been rediscovered in New Zealand. And Dr. Carrick will probably speak about the noisy scrub bird, an Australian endemic, which has been rediscovered in that country.

Unfortunately, good news is scarce for ornithologists and conservationists. According to a list recently established by the International Council of Bird Preservation, 26 bird species and 22 subspecies must be considered the most threatened at the present time. Among the vanishing birds, 19 are found in the Western Hemisphere, mainly in the West Indies. One occurs in Europe--that is the Audouin's Gull (Larus audouini) which has been probably never very numerous. Five of the threatened birds are in Asia, 18 in Australia, New Zealand and in the Pacific Islands (which have been so badly treated by man), and 4 in the islands in the Indian Ocean. No birds are immediately threatened in Africa, this continent is so large that a serious reduction in one area will not threaten the whole species. But even there we must be very careful because some species are already quite rare, for example Balaeniceps, the shoe-bill Stork, which has only a very small area of distribution in the swamps of eastern Africa.

In my opinion several species must be added to this preliminary list, which is only a kind of priority list. And many other birds require a thorough survey to determine their present status, the population having probably reached the critical level. Therefore, a kind of watch list must be prepared, and I am afraid that such a list would be rather long.

In spite of the large number of trained ornithologists and also of amateur bird watchers, we are terribly short of information on the present status and on the ecological requirements of most of the vanishing species. It is the duty of all of us, we zoologists, to get information on these aspects of our science, and I should like to make an appeal for birds.

It is also our duty to take care of them, for birds are an essential part of the animal kingdom--they have a great importance in the natural balance. And also as an English poet once said, "everybody is born with a bird in his heart."

RARE AND THREATENED MAMMALS IN AFRICA

Thane Riney
Consultant Ecologist
FAO/IUCN African Special Project
Morges, Switzerland

The following observations follow after visiting all of the savanna and steppe areas of Africa, from Senegal to the Red Sea and from the Sudan to Capetown. The immediate dangers are not as great as we had feared and the list of animals immediately threatened within the next few years is small, but of course no species of African mammal can be said to be completely secure for all time. In the present discussion I will try and indicate some of the factors responsible for the process of animal extinction in Africa, submit a list of African mammals immediately threatened, review some of the difficulties in obtaining a perspective of the subject of threatened animals in Africa and some of the trends already under way to reduce the process of extinction.

Let us consider even in very broad terms the historical setting for the present trends toward the extinction of African mammals and their habitats. On an African-wide basis this has involved the impact of man on the African environment in some regions for at least the past sixteen centuries. (I refer here to the Arab influence and have taken this as a starting point for the present discussion.) European influence has been a major influence only within the past hundred years.

The significance of the kaleidoscopic changes resulting from the impact of man may be summarized as follows: 1) As large scale habitat changes take place, the habitat becomes less suitable for certain species and more suitable for others. 2) The habitat changes, therefore, normally result in trends toward certain species increasing their numbers while other species diminish. 3) Some species have become locally extinct as the habitat has completely disappeared. 4) Some species, having decreased in numbers because of diminishing habitat, were subsequently eliminated locally by hunting. 5) Certain species have been eliminated locally by hunting alone. 6) The modern way of eliminating animals is to combine habitat destruction with shooting, for this results in the greatest acceleration of the trend toward extinction. 7) Certain animals have greatly increased locally following these large scale environmental changes, and examples of such species are spring hare, spring buck, impala, blue wildebeest, buffalo, elephant and, where hunting is not a significant factor, the black rhinoceros. 8) For most of these species and others not mentioned large increases such as have become apparent in recent years are largely in a transitory stage

of adjustment and their present favourable numerical status is by no means a guarantee of future survival.

In thinking about rare and threatened species in Africa the following distinctions between the terms "rare species" and "threatened species" have been used. Rare species have been so classified because the species exists only in a few restricted areas, or the present populations are everywhere very sparse. In some instances the classification may be influenced by the fact that the species is rare in the sense that it belongs to a relatively small zoological group, or that it represents some unusually distinctive zoological type.

To be regarded as a threatened species there should be some evidence of a trend toward extinction in recent years, or recent developments are such that seriously threaten the species either directly through increased shooting activities or indirectly through destruction of habitat.

On this basis the list of animals immediately threatened as a species reduces to 28 out of a possible total number of African species of 1,546 as indicated by Allen in his check list of 1939.

The threatened list here proposed includes the ten species of lemur and the fossa and fossane of Madagascar. The remaining 15 species include: Simien Wild Dog (Ethiopian wolf), wild ass, scimitar-horned oryx, addax, giant sable, nyala, dibitag, Hunter's antelope, Giant eland, Nubian and Walia Ibex, Beira antelope, Zanzibar suni, Rufous Gazelle and Atlas gazelle. Even for this short list the status of some of the species is not accurately known and it is possible that a better knowledge of their distribution and status would allow certain species to be removed from the top priority or critical list. There are doubtless a host of small mammals in a critical state but we know almost nothing of the status of small mammals.

The status of those species with African-wide distribution or very large ranges is in general not critical; the animals known as most eligible for inclusion at present are localised in their distribution and are either large enough to interest hunters, as with most ungulates, or are zoologically interesting groups, such as lemurs, with restricted distribution and with a range of distribution that is known to be small and becoming smaller. The principal reason for the decline of the majority of these critical species is the destruction of their habitat by man, although some species are critical because of hunting alone, and several are critical because of the combination of hunting and destruction of habitat.

Difficulties associated with the preparation of lists of rare or threatened species in Africa.

1. The species vs. subspecies question.

There is little doubt that priority emphasis should go to species, but the taxonomic status of animals in Africa is imperfectly

known save for a very few groups. There is an urgent need for the preparation of a check list of African mammals and an even more important need to reach some measure of uniformity between French, English and American collectors with respect to standard measurements recorded from mammal specimens.

2. Other difficulties in obtaining a continental perspective of the status of a species are:

a. Scarcity of complete documentation centers, including relevant literature written in French, English, Spanish, Portugese, Afrikaanse, German, Italian and Arabic.

b. Since one must largely depend on correspondence and published works, difficulties arise from differences in the local criteria used for including animals on critical lists.

c. The almost universal lack of trained biologists and appropriately staffed wildlife and parks departments and museums. The majority of African countries do not have a department dealing exclusively with wildlife, nor do they have universities producing zoologists to help with the simple but initially very important survey work needed to inventory the countries' wildlife resource.

d. Information is often lacking due to remoteness from road or rail systems, or to the wariness of certain forest species, or to human population vacuums due to the presence of some serious human disease, to fear of certain animals, to lack of water, or to taboos on certain areas.

When a single species is considered, normally several of these factors operate simultaneously to contribute to the difficulty of obtaining a balanced perspective. The chief difficulty in applying such criteria as we may have or may devise is not only lack of information but some workable system of obtaining this information. In Africa this is a very big job indeed.

Finally, it is important to summarize a few recent trends, for these provide both reason for guarded optimism and goals to work for.

At the same time as over-hunting and habitat destruction are accelerating the process of extinction, another set of human activities is, for various species in widely separated parts of Africa, resulting in a slowing down of the extinction process, and trends are already under way which, when encouraged and further developed, should result in insuring the safety of at least the major assemblages of African mammals as they are known today. There are six of these trends already under way--each a large subject in itself. These trends are: 1) The tendency for each country to establish wildlife organizations and to

develop a system of parks and reserves in which are protected the large mammals characteristic of the particular local environment. 2) The development of local research programs. 3) The development of the commercial utilization of game as a form of land use eminently suitable to African savanna and steppe conditions and as a means of making additional protein and money available in these areas. 4) The reintroduction of large mammals into appropriate habitat from which they have become locally extinct and in which they are protected and are increasing. 5) A recent trend for members of associations of zoological parks to refuse to purchase wild caught species which are removed illegally from the country of origin and subsequently offered for sale on the animal market, and 6) the capture and transport of mammals to zoos and to restricted, carefully selected habitats outside of Africa as a final desperate measure for the prevention of extinction.

These trends, singly or in combination, are being encouraged in several ways by international organizations such as IUCN, CCTA, FAO and UNESCO, and it is felt that this multilateral approach will have the greatest possible effect in conserving the African faunal resource. As one or more of these factors become locally effective the status of a rare and threatened species can be expected to improve. It is thus important to keep in touch with these developments, and to encourage them, to maintain an up-to-date view of the status of the species and, as new conditions dictate, to modify the extent to which we recognise certain species as critical.

VANISHING MAMMALS OF ASIA

Harold J. Coolidge
Pacific Science Board
National Academy of Sciences
Washington, D.C.

The baseline of our knowledge of extinct and vanishing mammals of the Old World lies in the Harper volume, already referred to, which was published in 1945 by the American Committee for International Wild Life Protection. In 1949 the idea of the Survival Service List for threatened and vanishing species was launched at the Lake Success Conference, as mentioned by Professor Baer. In 1955 Lee Talbot made a memorable mission to the Middle East and Asia for the IUCN and gathered fresh information on the status of the three Asian rhinos, the Indian Lion, and the Kashmir Stag, among other species. This was published in "A Look at Threatened Species," by the Fauna Society in London.

Now I am going to give you a very brief run-down, and possibly a count-down, on some of the Asian species of special concern to the Union's Survival Service Commission, based on our latest information, and I will touch on 20 forms.

Our greatest concern should be over the three rhinos, the rarest of which is the small Javan One-Horned Rhinoceros sondaicus. There are probably between 20 and 25 still surviving in the Udjung Kulon Nature Reserve, a peninsula of 117 square miles of tropical forest at the western tip of Java, and a few isolated animals may still exist on the Asiatic mainland. The Indonesian Government deserves great credit for giving this rhinoceros excellent protection against poachers, animal dealers, and procurers for zoos. I recall that just after the war a notorious Chinese poacher moved in to make his fortune by killing off the rhinos in this Reserve, but was, however, killed by a tiger. For many months the fear of tigers saved the remaining rhinos from being molested until the Indonesian Government organized its protective guards to set up a permanent watch on this Reserve which the Dutch had established and protected until the war and which the Japanese had carefully protected during the war. The Udjung Kulon Reserve is being maintained effectively at the present time by the Indonesian Government, but they have need of motorized equipment.

The second Asian rhino, the small Sumatran Two-Horned Rhinoceros, is estimated to number between 100 and 170 in widely scattered areas in Sumatra, Borneo, and Malaya. There is one living female in the Copenhagen zoo. These Sumatran rhinos are so scattered that they probably cannot find each other to breed. This will probably lead to their extinction, which is greatly hastened by the fact that their horn carries such a value.

The Great Indian Rhinoceros is now found only in 8 sanctuaries in India and Nepal, with estimated numbers of 600 in 1961. There are 26 in 18 zoos.

The reason that the rhinos are in such trouble is the sale of their horn for Asian medicine, especially as an aphrodisiac. I recall there were three mounted specimens in the Bogor Museum, not far from Djakarta, that had their horns stolen. When these were replaced by plaster models, the replacements were stolen three times within a single year. Perhaps we should encourage the formation of a Chinese pharmaceutical company to issue a synthetic rhinoceros horn mixture containing real hormones, in order to break the market that so gravely endangers the surviving Asian and African rhinos. This should be given further study.

Cheetah - There are estimated to be about 200 of the Iranian race Venaticus left. There is another race of cheetah found in Southern Russian Turkestan on which we have no information. The cheetah is one of our vanishing species because of over-shooting and the destruction of its habitat.

Asiatic Lion - This is one of the most interesting animals in Asia, and there are approximately 250 still surviving in one area of the Gir Forest, an area of about 500 square miles in Gujarat State in Northwest India. These lions are well protected and, while their habitat is being encroached on by domestic livestock all the time, the lions are retaliating, because they are reported to kill from 10 to 20 head of domestic cattle every day. There are not many places in the world where people would tolerate having the lions in a preserved forest destroying domestic cattle at that rate, but this has been going on for a great many years. Obviously, the population of lions in the Gir Forest should be managed to the extent that they should be reduced to the number the Forest can maintain and the others captured with modern tranquilizing drugs and removed to other reserves in India. There is a project proposed, in which the Indian Government is interested, and which I hope will bring this about within the next few years.

Persian Wild Ass - Their estimated number in 1960 was 300, and 60 in 17 zoos. Their reduction is due to over-hunting, competition with livestock, and some animal diseases.

Indian Wild Ass - This animal is also found in the Gujarat State. They were supposed to have numbered about 5,000 in 1946, and there were only 870 in 1962. There are 4 in zoos.

Wild Bactrian Camel - This animal, which is found in the Altai Desert, south of the Gobi Desert, and in parts of Singkiang, is said to be reduced to between 400 and 500 due to hunting pressure and competition of domestic animals.

Eld's Brow Antlered Deer - Three races of this deer are endangered, the Thamin in Burma is estimated at between 3 and 4 thousand; the Manipur, estimated at about 100; and the Thailand race. All of these have been greatly reduced by shooting and habitat destruction.

The Mesopotamian Fallow Deer - This animal is found in Southwest Iran. It numbered 200-400 in 1961. There are two females in zoos. This again has been brought to the edge of extinction by habitat destruction and hunting.

Kashmir Stag - Estimated at 2,000 in 1947; there were only about 175 left in 1962. This reduction is due to excessive hunting and destruction of habitat.

Kouprey - This rare forest ox in N. E. Cambodia is an animal in which I have a special interest. Only one living animal has ever been known to have been in captivity. This animal had estimated numbers of about 1,000 in 1952, but it is believed only about 350 remain in 1964. Their reduction has been due to habitat destruction and excessive hunting for meat in spite of the protective laws of Cambodia, which forbids animals to be killed.

Tamarau - This small wild buffalo in the highlands of Mindoro in the Philippines is estimated at about 300 animals at the present time, and there is one in the Manila Zoo. Of this number about 50 are found on Mt. Iglit, where the Government hopes to establish a reserve.

Wild Yak - This animal is found in North Central Tibet. It has greatly declined in number in recent years because of heavy hunting pressure. Seven are reported to be in Russian zoos.

Dugong - Across the Pacific and especially in the Asian area, the Dugong has been destroyed because of the value of its meat and oil. Efforts are under way to establish a sanctuary for this animal in the Puttalum Lagoon, Ceylon, where 371 were recently killed within two years.

Ceylon Elephant - This animal is now reduced to between 1,000 - 1,500, and of this number about 150 are domesticated. This reduction is due in part to hunting pressure, but mostly because of reduced habitat.

Now on the good news side, mention should be made of two forms extinct in the wild but saved in captivity: Pere David's Deer, which went out in the Shang Dynasty but was saved by the Duke of Bedford who established a herd of 16 animals at Woburn Abbey in 1901. In 1961 there were 389 healthy animals scattered in a number of different zoos and parks in Europe and in this country.

The second animal extinct in the wild form, but saved through zoos, is Przewalski's Horse from Mongolia and Sinkiang. This animal

now members 89 in captivity, 15 having been born in 1961. A stud book is maintained on this horse at the Prague Zoo.

The final species to mention is the orang-utan. While this animal is not yet in danger of extinction, it is diminishing at an alarming rate due to the fact that a young animal sells for as much as $2,000 in the United States. Almost every one imported is illegal, because export from Borneo and Sumatra, which is their native natural habitat, is forbidden by the countries of origin, Malaysia and Indonesia. Three months ago we had an authoritative report that there were 84 prang-utans in the smuggling pipeline.

There are now approximately 248 orangs in the zoos of the world and very few are born in captivity. I believe the Rotterdam Zoo has the record of 5 births. If we are going to help the Indonesian and the Malaysian Governments stop this "red slave" traffic, the only way to do it is to exhibit only legally exported animals. If animals that have not been legally exported from country of origin are put on exhibition, protests should go to the embassies and something should be done about it.

What can we do about the general situation of these vanishing species I have mentioned? First, there is an urgent need for competent ecological studies of each of these forms in their native habitat in order to understand what steps can be taken to save them from extinction. Next, where they do not exist, well-defined and well-protected strict nature reserves should be established to include a large enough area of the native habitat of these animals to give them the needed protection and room for propagation. Finally, breeding herds could be set up in carefully selected free-ranging zoo enclosures under optimum conditions of climate for animal health to safeguard the stock and supply animals that would, if needed, be re-introduced into their original environment. In this the zoo directors and their scientific advisers can work closely with the Survival Service Commission of the IUCN. We particularly need the help of zoologists the world over in meeting this problem, and I leave a plea with you to encourage your most promising students in zoology to devote their efforts to studying the ecology of some of these vanishing and endangered species in order to help us to establish measures to assure their survival.

Footnote: Figures on numbers of animals of vanishing species are based on information available to the Survival Service and the Red Book, but cannot be considered as precisely accurate.

CLOSING REMARKS

Jean G. Baer
Institut de Zoologie
Université-Mall
Neuchatêl, Switzerland

I do not want to presume that you are not ready to leave, but I would like to try and sum up a few points. You have probably discovered yourselves that in spite of the variety, sometimes the disparity of the subjects treated this evening, there are a certain number of common denominators.

And the principal ones are: The change of habitat, which nobody has stressed. It is not a very important factor, but it has occurred in the past, and it has occurred again since, in certain parts of Africa I know of. Natural upheavals, such as volcanic activity, which may have as a consequence the diverting of a river, the drying up a country, the burning out a forest. Then we have natural fires, that is fire lit by lightning, as you see them in forests. This should perhaps not be exaggerated, because when lightning strikes in a tropical rain forest the damage done is relatively small; there is such a tremendous amount of moisture in the forest that it doesn't burn. But human activities are the principal causes for disappearance and destruction - destruction of the habitat by modification such as dams, deforestation which leads to erosion.

Many of you who have come to Europe have seen the Mediterranean area which, together with your own dust bowl, are perhaps among the worst monuments to human activity in the world. Then we have modifications due to pesticides, and the whole pesticide chain that is being worked out now in this country and elsewhere leading from DDT dissolved in water up to the animals, what we might call the secondary part of the chain, the animals having fed one upon the other and DDT going right through and becoming concentrated in the last animal. And when that animal is man, it concentrates in his fat.

How can we hope to have results, positive results? The first thing that comes to one's mind is breeding. Breeding in captivity, that is in zoos, or in some area set aside which may not necessarily be identical with the original biotype. It has come out of much of the work done on breeding in zoos that some rare animals can be perfectly well bred under conditions of climate which are totally different from the original habitat. I will take as an example the Indian rhinoceros, which is found in the steamy, hot, humid regions of Nepal and Assam and which breeds in such an out-of-the-world (i.e., for rhinoceroses) place as the Basel Zoo in Switzerland. And they

breed successfully. It is not so much a question of habitat as a question of food; as a question of finding the right vitamins and the right hormones that must be fed to these animals to keep them in a breeding condition.

Such research should be supported, and is supported, by the International Union in the hope of being able to build up breeding populations so that zoos need no longer capture animals in the wild, but can buy them bred in zoos. An animal that is born and bred in a zoo is much more adapted to other zoos than an animal caught in the wild. The death rate is extremely low. This applies also to the great apes.

As you know, the gorilla can be bred in captivity now, as well as orangutan; but as one of the zoo directors, who is a member of the International Zoo Directors Organization has told me, the number of disreputable zoos is much larger than the other kind. One could never treat those zoos as scientific institutions, and consequently other measures will have to be taken.

Then there is the possibility of transferring populations with a view towards saving them. Mr. Thane Riney alluded to this. It has occurred in Africa, for instance--transfer of rhinoceros from one part of Africa to another. This was done for the white rhino particularly in the Southern part of Africa. One population moved to another area, and about a month ago our Union received a plea from an African state asking us to remove a herd of elephants that were doing damage in one part of the country into a national park situated in another part of the country. Now this is rather a tall order. One wouldn't remove a herd, but one might remove a breeding population, because it takes a lot to tranquilize an elephant, and once you've got it tranquilized you've got to move it.

All this leads us to the fact that what we need, and need vitally, is information. IUCN has started to build up an information center at its headquarters in Morges, Switzerland. And it is building it up slowly, but it can only build up this information if information is fed in. As Dr. Coolidge told you, we would like to put in a very serious plea. We need the help of the zoologists throughout the world for information. Information that we can be sure of, information that can be used and put on file for future reference and future use. If we want to save the wildlife of the world, it cannot be done by a handful of men. It must be done by all the zoologists of the world, be they vertebrate or invertebrate zoologists. After all, what is this wildlife of the world? Is it not something that was given us? Something for which we are responsible? And it is something that we've got to pass on to the next generation as intact as possible.